The importance of patient positioning in medical imaging experience and practice

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Introduction

There has never been a more relevant time to discuss patient experience in healthcare. Patients can articulate, better than ever before, their preferences and needs, and different healthcare strategic documents require patient and public involvement to ensure the service provided meets the needs of its intended audience and service users[1]. The rise of the "expert patient", a person who is expert by "lived experience" is changing how we do medical imaging and other aspects of patient care[2,3]. Furthermore, many research projects and funding applications now require direct patient engagement in all aspects of the project pipeline, to ensure "everything about the patients is designed by them and with them"[4,5].

One of the most central areas affecting patient experience in radiology and radiography, excluding the communication between healthcare professionals and patients, is patient positioning[6-8].

Positioning is the act of preparing the patient to undertake a medical imaging examination, in order to expertly delineate the required anatomy and pathology, while keeping patients safe and comfortable and it is vital for so many aspects of patient experience but also patient outcomes. It can involve the positioning of the whole-body anatomy in relation to the image receptor (anterior-posterior, posterior anterior, supine, prone or decubitus, for instance) but also in relation to the examination table[9] and/or the positioning of a particular body area to facilitate imaging with the use of positioning aids e.g. immobilisation of elbow or knee joint .

Positioning aids for patient centred care

There is now a wealth of positioning aids available to achieve this, each one with its own merits and challenges. There are foam pads, pillows, beaded support systems, hoists, wedges in all shapes and sizes, to name just a few. Positioning can be an intimate task, as it often involves "touching" the patient to explain and show how to lie down on the imaging equipment or to move them if needed to a different position for the examination. Many patients often said that this is the part of the examination that mostly "stays with them" as it is an opportunity for human interaction with another person at a time they feel at their most vulnerable[10].

The ideal positioning tool needs to meet all the following conditions, in addition to being able to facilitate the act of patient positioning itself:

a) it needs to be safe and not creating any additional risks for staff or patients; this might also include that it will not warm up during the examination (which might create risk of burns) or interact in any other way with the medical imaging equipment (attracted or repelled by it, such as, for instance, in MRI projectile events) or inadvertently increase radiation dose for any examination (e.g. CT examinations)

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b) it needs to be cleanable for infection control (more relevant now than ever, given additional measures introduced to prevent cross-infection from contagious or infectious diseases, including Covid-19)

c) it also needs to be compatible with imaging (not overlapping with patient anatomy or pathology) and complying with the imaging principles of each imaging modality, to avoid creating image artefacts that may impact the imaging outcome of the examination, for example materials with high susceptibility, that can disrupt the magnetic field in MRI, or materials that can create a shadowing artefact in ultrasound or absorb x-rays are to be avoided as positioning tools, as they disrupt the process of image creation.

d) Ideally it needs to be flexible or moldable, to ensure it can assume the shape or size needed for each patient, to customise and personalise their positioning .

In the vast majority of the cases the person responsible for patient positioning in medical imaging and treatment planning within radiology is the radiographer, also known as medical radiation technologist (MRT). While the principle of radiographic positioning is formally taught in all undergraduate radiography programmes, it also takes quite some practice and experience over time for this skill to be refined and perfected; radiographers often need to be quite resourceful in the use of patient positioning equipment and innovate "on the spot" to customise to their patient needs every time, as required, to delineate the anatomy and pathology of interest.

Importance of optimal patient positioning

There are many benefits to optimal patient positioning for medical imaging and radiotherapy. First of all, optimal patient positioning ensures patient comfort and maximises patient co-operation throughout their imaging procedure for a successful completion of their examination.

Comfort can relate to minimisation or avoidance of any new pain on tension in the body; it can also relate to the patient having the optimal support for parts of anatomy that they may already know to have an injury or weakness, to avoid aggravating this injury or weakness. As a consequence, patients can stay still for longer, if needed, to complete a successful examination and to get the optimal diagnostic result.

A patient who can remain still because of optimal positioning, minimises the occurrence of any motion-related image artefacts, which can hamper diagnosis, and therefore allows optimal treatment pathways. These artefacts can manifest themselves as ghosting, blurring or ringing artefacts on images and they severely affect image quality, minimising diagnostic confidence[11]. While many different imaging sequences are now faster than ever before to allow some degree of motion resistance and software exists to correct for motion, optimal positioning ensures the raw, native imaging data have the best quality for diagnosis.

Furthermore, optimal patient positioning creates trust between the patient and the healthcare provider and ensures a positive patient experience. Optimal patient experience is central to the delivery of healthcare, as it ensures the patient will come back for another examination, if needed, for the continuum of diagnosis and treatment. It also supports positive feedback for the healthcare provider and diagnostic procedure; as this feedback can now be shared with many other users through social media and beyond, every effort to improve patient experience is like an extra "vote of confidence" to the healthcare system and procedure involved. Patient experience is so vital that it is captured as part of economic analysis for healthcare delivery in patient reported experience measures (PREMs).

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Optimal patient positioning is also vital for patient safety as it can reduce dose, minimise scan time and improve patients' vital signs during imaging. For instance, supine positioning for pregnant people during MRI scans should be avoided, with a preference to a left lateral tilt, to prevent inferior vena compression[12].

AI and the future of patient positioning

Finally, but very importantly, patient positioning is central to the reproducibility of acquiring data for clinical trials, artificial intelligence tool design, validation, evaluation and redesign. As large numbers of data are needed to train an AI algorithm, standardisation of positioning is vital for anatomical landmarks to be decided within that large sample size but also for pathology localisation. Given the variety of patient body habitus, positioning in these AI studies can often be the only, and much needed constant, for accurate measurements to occur. Conversely, AI technology can be used to evaluate the variability of patient positioning as a vital reference point for the evaluation of image quality and diagnosis[13].

Standardised patient positioning is also necessary for medical imaging longitudinal studies to show progression of disease or for treatment monitoring. Standardisation of positioning during data acquisition for AI tool design is vital for optimal image quality (signal-to-noise ratio, contrast, spatial resolution and avoidance of image artefacts) to ensure the differences in imaging result from the different AI algorithm permutations and not from patient induced variations. Despite all these new technologies, patient positioning remains vital as it provides the ground truth and reference for image quality from native, unprocessed data.

Future patient positioning tools will need to comply with increasingly complex safety guidelines but also be adaptive to the imaging modality of use and patient habitus and preferences. Infection control will remain a key focus beyond the pandemic and positioning tools should be easy to disinfect. These tools will also need to address the needs of the increasingly ageing population but also hopefully, with increasing accessibility to healthcare of different populations, after years of advocacy and research, these tools will need to be co-designed and tested by patients themselves, to improve their experience and directly address their complex needs and preferences. This is an exciting time and one where direct patient input can shape future healthcare provisions in positioning and beyond, exactly as it should be, as it is their needs we need to meet and their preferences to address.

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